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FABRIC AND METHOD OF MAKING SAME

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This invention relates to the production of crepe fabrics containing crepe yarns of an organic derivative of cellulose, which fabrics have a full, heavy hand and which may be dyed or printed with dyestuffs employed in dyeing cotton.

An object of the invention is the method of producing a weighted crepe fabric containing yarns of cellulose acetate or other organic derivative of cellulose wherein the weakening effect of the normal delustering boil-off is avoided. Other objects of this invention will appear from the following detailed description.

It is often desired, in the production of crepe fabrics containing organic derivative of cellulose yarns, to soften the luster and increase the covering power of the same. This may be accomplished by treating the fabric in delustering baths at or near the boiling point. Baths at or near the boiling point have considerable effect on the crepe of the fabric as they cause the developing of the crepe effect by swelling and plasticizing the organic derivative of cellulose yarns. It is very difficult and in some cases impossible to produce the desired luster and covering power and at the same time effect the desired type of crepe. Furthermore, the long treatments in heated baths necessary to produce a distinct matt appearance softens the theromoplastic yarns to such an extent that the fabric is weakened and also permits some of the crepe to be pulled out. We have found that crepe fabrics having high covering power and softened luster may be produced by weighting the fabric prior to or during a development of the pebble in the crepe fabric. Fabrics having a full mellow hand and being resistant to hot ironing may be produced by this method. When a 10 to 20% increase in weight of the fabric is produced by the weighting treatment the fabric possesses a good affinity for direct cotton dyestuffs and shows clear washable discharge prints.

In accordance with our invention, we treat organic derivative of cellulose yarns having a crepe twist or fabrics containing such yarns with a solution of a soluble compound of a metal, suitable for weighting purposes, at an elevated temperature but below the creping temperature for the short period of time the materials are being treated therewith, then treating them a second time in a similar solution at a reduced temperature, then hydrolyzing the absorbed metal compound with cold water and then phosphating and/or silicating the fabric, at least one of the latter baths being at a temperature sufficiently high to develop the desired pebble effect in the fabric. Although compounds containing tin have been found most practical, the weighting compound may be any suitable soluble metallic weighting compound such as those containing titanium, zinc and antimony, etc. These compounds are employed in the same manner as above, that is, by treating the yarn or fabric containing an organic derivative of cellulose for a short period of time in a heated bath containing a soluble compound of the weighting metal, then treating the yarn or fabric in a second bath of the same or different weighting metal at a reduced temperature for a sufficient period of time to cool the fabric, and then converting the soluble metallic compound absorbed by the yarn or fabric to an insoluble compound by a hydrolyzing, phosphating, silicating and/or other like means of producing an insoluble compound from the soluble compound. If a fabric is being treated, at least one of the later treatments is preferably effected in a heated bath of a temperature sufficiently high to develop the crepe in the fabric simultaneously with the conversion of the weighting compound to the insoluble form. However, either yarns or fabrics may be treated in baths all of which are below a temperature that would effect a creping action and then at some later time the yarns or fabrics may be subjected to a creping bath.

Although the invention may be employed in treating highly twisted yarns prior to weaving or knitting them into a fabric, it is primarily concerned with the treatment of fabrics that contain highly twisted thermoplastic yarns. The invention is especially applicable to fabrics formed substantially of crepe yarns of cellulose acetate or other organic derivative of cellulose. The cellulose acetate crepe yarns may be those formed by twisting the yarn to from 50 to 80 or more turns per inch in the presence of steam or hot water or other plasticizing medium. For example, the crepe yarns of organic derivatives of cellulose may be those produced by methods described in U. S. Patents Nos. 2,088,587, 2,088,628, 2,089,187, 2,089,188, 2,089,189, 2,089,190, 2,089,191, 2,089,192 or by other methods of imparting high twist to an organic derivative of cellulose yarn.

The crepe twisted yarns, or at least a part of the filaments or fibers contained in said yarns, may be made of any suitable organic derivative of cellulose such as the organic esters of cellulose and the cellulose ethers. Examples of the organic esters of cellulose are cellulose acetate, cellulose formate, cellulose propionate and cellulose butyrate, while examples of the cellulose ethers are

ethyl cellulose, methyl cellulose and benzyl cellulose.

The crepe twisted yarns of organic derivatives of cellulose may be the sole constituents of the fabric to be treated or the fabric may be formed of these yarns interwoven or knitted with other yarns in the warp or weft, or both. For instance, the fabric may contain the crepe yarns of an organic derivative of cellulose and yarns of an organic derivative of cellulose not crepe twisted, or yarns of other materials such as silk, cotton, regenerated or reconstituted cellulose, with or without a crepe twist.

The fabrics or yarns made from or containing an organic derivative of cellulose may be treated with any suitable weighting compound, for instance, those containing tin, zinc, cadmium, titanium, antimony, etc. The weighting compound may be placed in or on the textile materials as a soluble salt such as, for example, the chloride of the metal, and then converting by hydrolyzing, phosphating, silicating and the like or by a combination of such treatments to the insoluble or relatively insoluble oxides, hydroxides, phosphates, silicates, or other insoluble compounds. In the weighting of a fabric with a tin compound the fabric is subjected to the treatment of a heated solution of the soluble weighting compound for a short period of time. The temperature of this solution is preferably between 30° C. and 60° C., as temperatures above this tend to develop the pebble in the crepe fabric, while temperatures below this do not effect a uniform and thorough penetration of the weighting compound into the fabric. Prior to hydrolyzing, phosphating or silicating the thus treated fabric, it is preferable to treat said fabric in a bath of a composition similar to the first bath and maintained at or below room temperature, say about 15° C., to reduce the temperature of the fabric prior to exposure of same to the air or other reacting agents. It is also preferable to so carry out the process that that fabric is exposed to as little air as possible between the heated bath and the cool or cold bath. Although a cold bath of a temperature of about 15° C. is preferred, the cold bath may be of any suitable temperature below 25° C. which will reduce the temperature of the fabric to that of room temperature or below prior to exposure of any elements other than the soluble metallic compound employed as the weighting metal.

The fabrics are preferably treated in a hot bath and a cool or cold bath, each containing a soluble weighting compound at a concentration between 20° and 38° Bé. The duration of the treatment in the hot bath is preferably from 0.5 to 4 minutes, while the treatment in the cool or cold bath is a duration sufficient to reduce the temperature of the fabric to below room temperature, which time is usually from 2 seconds to 1 minute. The fabric may be given 1, 2 or any number of passages through the hot and cold baths of the soluble weighting compound, with or without converting the weighting compound to the insoluble state after each passage therethrough. For instance, a fabric containing cellulose acetate may be treated for 1 minute in a heated bath of tin chloride of 30 to 35° Bé. maintained at about 54° C. and 0.5 minute in a cold bath of similar composition and strength maintained at about 18° C. This treatment will impart to the fabric from 18 to 22% of weight increase which is sufficient weighting to change the affinity of the fabric for dyes such that it may be dyed or printed with direct cotton dyestuffs. One such passage of a cellulose acetate fabric through the heated and cool baths of the tin chloride, then hydrolyzing, phosphating and silicating produces from 18 to 22% weight increase, while the second passage through the hot and cold tin chloride baths, then hydrolyzing, phosphating and silicating raises the weight increase to from 25 to about 35%.

The hydrolyzing of the soluble weighting compound absorbed by the fabric may be accomplished by flushing the fabric with cold or slightly warm water. It is preferable in the case of tin weighting to flush the fabric, for example, by means of sprays with hard water maintained at about or below 20° C. The phosphating operation may be accompanied by immersion of the fabric for from 15 to 45 minutes in a bath of sodium or other alkaline di- or tri-phosphate. The concentration of the phosphating solution is preferably from 5° to 7½° Bé. After the phosphating operation, it is preferable to wash the fabric prior to a second passage through the soluble weighting metal compound or prior to silicating, if either of these operations are to follow. The silicating treatment preferably consists in immersing the fabric for from 15 to 90 minutes in a solution of sodium or potassium silicate maintained at about 55° C. and having a concentration of from 1.5° to 3.5° Bé. The fabric after being treated in a bath containing a soluble weighting metal compound may be either phosphated or silicated, or both. The fabric may be phosphated and then silicated or silicated only.

Some development of the crepe will take place in either or both the phosphating or silicating bath where the duration of treatment approaches the 45 minute period. If a full development of the crepe is desired, the temperature of the phosphating or silicating bath may be increased to, say, around 65° or more, it being preferable to slightly lower the concentration of the phosphating or silicating compounds with the increase of temperature. It is also preferable to maintain the fabric in a relatively flat position as treatment in a rope or hank form tends to develop permanent creases and even cracks in the crepe fabric. If desired, however, the durations of the phosphating or silicating treatments may be of shorter period, say, approaching the shorter or 15 minute period, or by a slight reduction of the temperature to around 50° C. such that little or no shrinkage of the fabric takes place, that is, little or no development of the crepe takes place even after washing and drying the fabric. The fabric may then be subjected to a creping bath consisting of water with or without soap at or near the boiling point.

The fabrics are preferably treated by a continuous process wherein the fabric in open width and fairly well supported by aprons or rollers is drawn through the baths of the soluble weighting metal solution for a short period at elevated temperature and then through a bath or baths to convert the soluble weighting metal compound to the insoluble or relatively insoluble state. The hot and cold weighting baths are preferably so arranged that the fabric is exposed to as little air as possible in going from one to the other. Furthermore, when employing a hydrolyzing step the fabric should be flushed with water as soon as possible after leaving the cool or cold weighting bath.

As one method of carrying out the invention, fabric in roll form may be supported at one end of a series of tanks. The first tank may, for in-

stance, be 10 feet long, 4 to 8 inches deep and rubber lined. This tank is provided with means to maintain the fabric submerged in the same, and with means to maintain the desired temperature and concentration of the solution therein. The fabric is drawn through and over the edge of the tank into a second tank. The second tank may be, for instance, 2 feet long, rubber lined and provided with means for maintaining the reduced temperature and the proper concentration of the solution. From the second tank the fabric may pass over a roller and between a pair of nip rollers into a water spray and washer. From the water spray and washer the fabric may be drawn through tanks in a circuitous manner, which tanks are equipped with means to maintain the temperature and concentration of the usual phosphate and/or silicate baths. The travel of the fabric through the various tanks are so arranged that, by constant drawing of the fabric through the series of tanks, the fabric will be treated in the first, or heated weighting, tank for one minute, in a second, or the cold weighting, tank for 15 seconds, under the water spray for two minutes, in the third and fourth tanks which contain the phosphating or silicating bath for 30 minutes. After being removed from the last tank the fabric may be passed through extraction rolls to remove a substantial part of the liquid and then tenter dried or air dried while in a flat condition. The fabric may then be ironed or otherwise treated, printed, dyed, etc. and packaged. Obviously, tanks of any manufacture and construction may be employed depending upon the time desired and the speed of the fabrics being drawn through the same.

As an illustration of our invention, but without being limited thereto, the following example is given:

Example

A fabric consisting of a cellulose acetate yarn warp and a cellulose acetate crepe yarn filling woven with two picks right hand twist and two picks left hand twist is scoured cold and dried to remove lubricants and finished applied during the processing of the yarn, and is then treated for one minute at a speed of 3 to 5 yards per minute in a bath 30 times its weight of stannic chloride having a concentration of 33° Bé. and at a temperature of 53° C. The fabric is then treated 15 seconds with a cold bath of stannic chloride of the same concentration, said bath being maintained at from 10 to 15° C. The fabric is then passed through rubber covered nip rollers and immediately subjected to a flushing with cold water to hydrolyze the stannic chloride. It is found that there is no alteration of the width or appearance of the fabric during its immersion in the hot and cold stannic chloride and the subsequent hydrolyzing treatment. The fabric is then phosphated in a 6½° Bé. di-sodium hydrogenphosphate at 50° C. to 30 minutes followed by a rinse in water of a similar temperature and a silicate treatment in 2½° Bé. sodium silicate at 55° C. for 45 minutes. The fabric is then rinsed and air dried. Some development of the crepe in the fabric took place during the phosphating treatment and more development took place in the silicating treatment at a temperature of from 50 to 55° C. The appearance of the fabric is one of a fine pebble crepe. With a temperature of about 60° C. in the silicating bath a more pronounced pebble is produced on the fabric. The fabrics have a full mellow hand, have affinity for cotton dyestuffs and have a resistance against the filling slipping on the warp, also resistance to hot ironing.

It is to be understood that the foregoing detailed description is merely given by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention, what we desire to secure by Letters Patent is:

1. In a process of manufacturing crepe fabrics containing crepe producing yarns of an organic derivative of cellulose, the steps of impregnating the fabric having undeveloped crepe yarns of an organic derivative of cellulose with a solution of a soluble weighting metal compound at a temperature between 30° and 60° C. without developing the crepe of said fabric, cooling the impregnated fabric in a solution of the same weighting metal compound maintained at below 25° C. and converting the soluble weighting metal compound to an insoluble compound by treatment in a bath maintained at a temperature sufficiently high to develop the crepe of the fabric during the time the fabric is in contact therewith.

2. In a process of manufacturing crepe fabrics containing crepe producing yarns of cellulose acetate, the steps of impregnating the fabric having undeveloped crepe yarns of cellulose acetate with a solution of a soluble weighting metal compound at a temperature between 30° and 60° C. without developing the crepe of said fabric, cooling the impregnated fabric in a solution of the same weighting metal compound maintained at below 25° C. and converting the soluble weighting metal compound to an insoluble compound by treatment in a bath maintained at a temperature sufficiently high to develop the crepe of the fabric during the time the fabric is in contact therewith.

3. In a process of manufacturing crepe fabrics containing crepe producing yarns of an organic derivative of cellulose, the steps of impregnating the fabric having undeveloped crepe yarns of an organic derivative of cellulose with a solution of a soluble weighting metal compound at a temperature between 30° and 60° C. without developing the crepe of said fabric, cooling the impregnated fabric in a solution of the same weighting metal compound maintained at below 25° C., hydrolyzing the weighting metal compound, subjecting the fabric for about 45 minutes to a phosphating bath maintained at about 54° C. and subjecting the fabric to a bath containing an alkali silicate whereby an insoluble compound is produced and the crepe of the fabric is developed.

4. In a process of manufacturing crepe fabrics containing crepe producing yarns of cellulose acetate, the steps of impregnating the fabric having undeveloped crepe yarns of cellulose acetate with a solution of a soluble weighting metal compound at a temperature between 30° and 60° C. without developing the crepe of said fabric, cooling the impregnated fabric in a solution of the same weighting metal compound maintained at below 25° C., hydrolyzing the weighting metal compound, subjecting the fabric for about 45 minutes to a phosphating bath maintained at about 54° C. and subjecting the fabric to a bath containing an alkali silicate whereby an insoluble compound is produced and the crepe of the fabric is developed.

5. In a process of manufacturing crepe fab-

rics containing crepe producing yarns of an organic derivative of cellulose, the steps of impregnating the fabric having undeveloped crepe yarns of an organic derivative of cellulose with a solution of a soluble stannic chloride at a temperature between 30° and 60° C. without developing the crepe of said fabric, cooling the impregnated fabric in a solution of the same stannic chloride maintained at below 25° C. and converting the soluble stannic chloride to an insoluble compound by treatment in a bath maintained at a temperature sufficiently high to develop the crepe of the fabric during the time the fabric is in contact therewith.

6. In a process of manufacturing crepe fabrics containing crepe producing yarns of cellulose acetate, the steps of impregnating the fabric having undeveloped crepe yarns of cellulose acetate with a solution of a soluble stannic chloride at a temperature between 30° and 60° C. without developing the crepe of said fabric, cooling the impregnated fabric in a solution of the same stannic chloride maintained at below 25° C. and converting the soluble stannic chloride to an insoluble compound by treatment in a bath maintained at a temperature sufficiently high to develop the crepe of the fabric during the time the fabric is in contact therewith.

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